porous cell prevents this from mixing with the fresher strong solution outside, and thus enables the operator to remove the exhausted portion.

AN adaptation of the telephone to the needs of deaf persons has been brought out by one H. G. Fiske of Springfield (Massachusetts). To the centre of the disk of the receiving telephone is attached a short rod of wood, ebonite, or other elastic hard material which can be held between the teeth. The sonorous vibrations imparted to the disk by the magnet are thus transmitted mechanically to the auditory nerves through the teeth and the bones of the skull. The advantages are probably limited, since, as experiments with the audiphone have shown, only a small percentage of truly deaf persons retain the power of hearing through the teeth. In the greater majority of cases it is the auditory nerve itself, not the mechanical adjustments and auditory apparatus of the ear, that is the cause of deafness.

GEOGRAPHICAL NOTES

SOME modifications have been made in the composition of the fifth International Expedition to Central Africa. Lieut. Harou, who was to have formed part of the expedition, will only join his companions at a later period on the Upper Congo. He is charged, meantime, with a secret mission to Africa, for the accomplishment of which about ten months are necessary. After the termination of this mission he will join the expedition. M. Harou will embark about the 23rd for his new destination. We learn that Dr. Dutrieux, who had to return from Africa to Belgium to recruit his health, is about to return to Africa to take part in the service for the abolition of slavery, at the head of which is Col. Sala. He had begun when in Africa a dictionary of the Suaheli language, so common all over Central Africa. Although incomplete, the Executive Committee of the Association have decided to print the dictionary as it is, and put it in the hands of travellers for correction and completion.

THE *Bereg* states that next autumn Baron Nordenskjöld will visit St. Petersburg to make preparations for his proposed expedition to the New Siberian Islands in 1882, the expenses of which will be borne by the Russian merchant, M. Sibiriakoff. Nordenskjöld will go to the mouth of the Lena overland, and thence embark for his destination.

THE Congress of French Societies of Geography was held this year at Nancy during the first week of August. M. Levasseur, honorary president, gave an address, in which he reviewed the progress realised by the creation of so many geographical societies. In the evening the members were invited to the Town Hall, where they were entertained by M. Volland, the mayor. A number of toasts were delivered by his Worship, as well as by M. Levasseur and others.

A LETTER from Dr. Matteucci, written in May last, intimates the arrival of the expedition under Prince Borghese at El Fasher, the capital of Darfur, and the approaching departure for Wadai. Dr. Matteucci remarks on the almost absolute want of water in Darfur, and the consequent recent cultivation of water-melons by the natives as far as the arid soil will permit. They also utilise the Baobab tree in a curious manner. Hollowing out the huge trunk of the older trees by fire, they by some prehistoric primitive method get the hollow trunk filled with water during the rainy season, the water keeping sweet for eight months. The people of Darfur, Dr. Matteucci says, are still in a primitive uncorrupted condition, a contrast to the Egyptianised natives of Kordofan.

M. BISCHOFFSHEIM pays the expenses of M. G. Capu, a young geologist and botanist, who will accompany M. de Ujfalvy on his new mission to Central Asia, referred to last week; M. Gabriel Bovalt, as topographer and naturalist, will also accompany the mission.

THE ALGÆ OF THE SIBERIAN POLAR SEA[1]

BEFORE the voyage of the *Vega* our knowledge of the algæ of the Siberian Polar Sea outside the Kara Sea was limited to the fact of their existence in Tschaun Bay and along the coast between that bay and the mouth of the Kolyma. This information was obtained by Baron Maydell, the leader of a scientific expedition sent out in 1869, under the auspices of the Russian Geographical Society, to explore the Tchuktchi Peninsula. A statement previously made by Matiuschin, one of Wrangel's companions during his Siberian journey, that algæ exist at Tschaun Bay, was thereby confirmed. Maydell brought home with him only three incomplete specimens of algæ, which he obtained from a native living at Cape Schelagskoj. From the description given by him they appear to belong to the genera Alaria and Laminaria.

From observations made during the voyage of the *Vega* it appears that algæ exist at several places along the whole coast of the Siberian Polar Sea. They occur almost exclusively within the sublittoral region. In the elittoral area, which was the best and most completely examined during the expedition, Dr. Kjellman found only at two places, viz., between Port Dickson and Tajmur Island, an exceedingly scanty flora consisting of three species, two Florideæ—*Lithothamnion polymorphum* and *Phyllophora interrupta*—and a Phæozoosporacea —*Lithoderma fatiscens*. The littoral region along the north coast of Siberia is, like that of the coasts of Novaya Zemlya and clearly for the same reasons, nearly everywhere devoid of algæ. Only at two places did Dr. Kjellman find traces of a strand vegetation. They consisted of two small green algæ, *Enteromorpha compressa* and *Urospora penicilliformis*, both known from the same region in other parts of the North Polar Sea. Fucaceæ occur nowhere within the littoral region, not a single individual of this group having been found at any of the places visited between Port Dickson and Koljuschin Fjord near Behring's Straits. To the east of this fjord there was found in the sublittoral region in limited quantity *Fucus evanescens*, which is extensively distributed in the North Polar Sea. In the sublittoral belt of the bottom, too, the vegetation in the Siberian Polar Sea is very scanty. Dr. Kjellman had not an opportunity of examining any region where the flora was not considerably poorer in individuals than in those places on the coasts of Spitzbergen and Novaya Zemlya where algæ are pretty abundant. The eastern portion of the sea appears to be somewhat less poor in algæ than the western. The places where they most abounded were Cape Irkajpij—Cook's North Cape (N. L. 68° 55′ W. L. 179° 25′), and the mouth of Koljuschin Fjord. From the natives settled between this fjord and Cape Serdze, situated about fifty miles to the east of it, Dr. Kjellman repeatedly obtained during the first half of 1879 very large masses of algæ, which appears to show that a pretty abundant vegetation of algæ is to be found at certain places along this part of the coast. There are not wanting, however, in the western part of the Siberian Sea some comparatively very good places for algæ. One such at least was found, viz., the region round Tajmur Island, between Port Dickson and Cape Chelyuskin.

The species that occurred most frequently were *Polysiphonia arctica*, *Rhodomela tenuissima*, a variety of *Rhodomela subfusca*, *Sarcophyllis arctica*, *Phyllophora interrupta*, species belonging to the family Laminarieæ, *Sphacelaria arctica*, and *Phloeospora tortilis*. The Laminarieæ give in general their stamp to the vegetation; at one place however *Phyllophora interrupta*, at another the above-mentioned variety of *Rhodomela subfusca* occurred in quantity surpassing that of the Laminarieæ.

Of this family six species were found, viz., four species of Laminaria: *L. Agardhii*, *L. cuneifolia*, *L. solidungula*, and one belonging to the digitata group, in which Dr. Kjellman believed that he recognised the *L. atro-fulva* of J. G. Agardh, and two species of Alaria, one standing near to *A. esculenta*, the other corresponding in much to *A. musæfolia*, but probably belonging each to species allied to these, and yet incompletely known, which occur in the north part of the Pacific. The distribution of the Laminaria along the north Siberian coast is different. *Laminaria solidungula* occurs both east and west of Cape Chelyuskin. *Laminaria Agardhii* was found only at that promontory and at a couple of places west, but nowhere east of it. Eastward it is replaced by *L. cuneifolia*, found first at Irkajpij and afterwards east of it in comparatively large quantities. Both the two species of Alaria and *Laminaria atro-fulva* appear also to be confined to the eastern portion of the Siberian Polar Sea. None of them were seen west of Irkajpij. Some of the species already mentioned as occurring most frequently enter into the composition of the vegetation in different proportions east and west of Cape Chelyuskin. *Polysiphonia arctica* and *Phyllophora interrupta* were more common west; *Rhodomela tenuissima* again more numerous east of the northernmost point of Asia. *Phloeospora tortilis* was nowhere seen east of Tajmur Island, nor *Sarcophyllis arctica* and the variety of *Rhodomela subfusca* west

[1] Abstract of preliminary communication by Dr. F. R. Kjellman in "Ofvers. af Kongl. Vet. Akad. Förhandl.," 1879.

of Irkajpij. Hence it follows that the algal flora differs in its composition in a noteworthy degree in the eastern and western portions of the Siberian Polar Sea.

It has been stated that an abundance of large-sized luxuriant plants is a characteristic of the Arctic algæ. In this respect the vegetation of the Siberian Sea is considerably behind that in other parts of the North Polar Sea. The largest alga seen by Dr. Kjellman was a *Laminaria Agardhii*, whose length was 210 and greatest breadth 37 centimetres. Among the many specimens of *L. cuneifolia* examined there was none more than half so large as this. *L. solidungula* is about as large as middle-sized specimens of this plant from the coasts of Spitzbergen and Novaya Zemlya, about 90 centimetres long and 15 to 20 broad. The two species of Alaria, when they are largest, are about a metre in length. Other algæ almost without exception are stunted in comparison with plants of the same species from other portions of the North Polar Sea.

The collections of algæ made by Dr. Kjellman, according to the examination to which it has been possible to subject them, consist only of thirty-five species, of which there belong to the

Florideæ	12
Fucoideæ	16
Chlorophyllophyceæ	6
Phycochromophyceæ	1

These are not more than half as many as are known from the Murman and Spitzbergen Seas. With the exception of two, or possibly three, species, all also occur in other parts of the North Polar Sea.

The western part of the Siberian Polar Sea, at least to Cape Chelyuskin, must doubtless be considered to belong to the territory of the Spitzbergen marine flora, though poorer in individuals and species and more stunted than it. The algæ in the eastern part of the same sea also in a considerable degree correspond with those on the coasts of Spitzbergen and Novaya Zemlya, but in the composition of its Laminaria vegetation it has a trait foreign to the latter, and indicating a connection with the algæ in the north part of the Pacific.

ON THE COMPRESSIBILITY OF GLASS[1]

THE following experiments were undertaken with a view to determine by actual observation the effect produced on solids by hydraulic pressure. The instrument was constructed according to my directions by Mr. Milne, of Milton House, about two years ago, but it is only now that I have been able to devote myself to its application to the purposes for which it was designed. It consists of a hydraulic pump, which communicates with a steel receiver capable of holding instruments of considerable size, and also with a second receiver of peculiar form. This receiver consists essentially of a steel tube terminated at each end by thick glass tubes fitted tightly. It is tapped at the centre with two holes, the one to establish connection with the pump, and the other to admit a pressure-gauge or manometer. The steel tube may be of any length, being limited only by the extent of laboratory accommodation at disposal. The tube which I am using at present has a length of a little over six feet, and an internal diameter of about three-tenths of an inch. The solid to be experimented on must be in the form of rod or wire, and must, at the ends at least, be sufficiently small to be able to enter the terminal glass tubes, which have a bore of 0·08 inch, and an external diameter of 0·42 inch. The length of the solid is such that when it rests in the steel tube its ends are visible in the glass terminations.

When the joints have all been made tight the experiment is conducted as follows:—

A microscope with micrometer eyepiece is brought to bear on each end of the rod or wire. These microscopes stand on substantial platforms altogether independent of the hydraulic apparatus. The pressure is now raised to the desired height. as indicated by the manometer, and the ends of the rod are observed and their position with reference to the micrometer noted. The pressure is then carefully relieved and a displacement of both ends is seen to take place, and its amplitude noted. The sum of the displacements of the ends, regard being had to their signs, gives the absolute expansion in the direction of its length, of the glass rod, when the pressure at its surface is reduced by the observed amount, and consequently also by the compression when the process is reversed. As in the case of non-crystalline bodies, like glass, there is no reason why a given pressure should produce a greater effect in one direction more than in another, we may, without sensible error, put the cubical compression at three times the linear contraction for the same pressure.

As yet I have only experimented on glass, and only on one sort, namely, that made by Messrs. Ford and Co. of Edinburgh. It contains lead, and is very suitable for glass-blowing purposes. I have not yet analysed it. I have observed its compressibility up to a pressure of 240 atmospheres, and before proceeding to higher pressures I intend to determine the compressibilities of other solids, especially metals at pressures up to 240 atmospheres. The reason for taking this course is that having got two glass tubes to stand this pressure I am anxious to utilise them as far as possible before risking them at higher pressures.

The pressure in these experiments was measured by a manometer, which consists simply of a mercurial thermometer with a stout bulb, which is immersed in the water under pressure, whilst its stem projects outside.

The values of the readings of this instrument were determined by comparing it with a piezometer containing distilled water. This piezometer had been compared with others which had been subjected to the pressure of very considerable and measured columns of water on the sounding-line.

The mean apparent compressibility of water in glass was thus found[1] to be 0·00004868, or, multiplying by 1,000, to reduce the number of figures 0·04868 per atmosphere at temperatures from 1° to 4° C.

The manometer (No. 2) was compared with this piezometer. The temperature of the manometer was 12°·5 C., while the piezometer was enveloped in ice in the receiver. The ice was thus melting under the same pressure as the instrument was undergoing, consequently the piezometer was not exposed really to precisely the same temperature at each succeeding experiment.

For our present purpose the effect of the possible variation in volume due to this thermic cause is negligable, and we assume that the indications of our piezometer are comparable with those obtained in deep ocean waters. In a future communication I hope to return to this point.

In Table I. we have in the first column the number of observations meaned for each pressure from which the average values of the manometer-reading under A, and of the piezometer-indication under H are computed.

Manometer No. 2, when treated simply as a thermometer, showed at atmospheric pressure a rise of one division for a rise of 0·233° C. in temperature. Piezometer K, No. 4, was filled with distilled water, and contained 7·74 cubic centimetres at 0° and atmospheric pressure. It is made of Ford's glass, though not drawn at the same date as the experimental rod.

TABLE I.—*Comparison of Manometer No. 2 at 12·5° C. with Piezometer K, No. 4, in ice melting under pressure*

Piezometer K, No. 4, contains at 0° and atmospheric pressure 7·74 cub. cent. of water.	Number of observations meaned.	Pressure in divisions of manometer No. 2.	Apparent contraction of water per thousand. K, No. 4.
		A.	H.
Temperature of manometer 12·5° C.	4	26·08	4·0228
Piezometer immersed in ice... ...	4	30·28	4·6534
Melting under pressure A	1	36·20	5·5972
Probable temperature between − 1° and 0° C.	5	40·08	6·1045
	3	50·08	7·6043
	3	60·20	9·1057
	3	70·08	10·5163
Total number of observations ...	23		
Mean reading of manometer ...	... ...	43·61	
Mean apparent contraction of water in piezometer	... ...	... ...	6·6495

Dividing the mean apparent contraction of the water in the piezometer by the apparent compressibility of water in glass (0·04868), we have for the pressure corresponding to a rise of 43·61 divisions on manometer No. 2 at 12·5° C.

$$P = \frac{H}{0{\cdot}04868} = \frac{6{\cdot}6495}{0{\cdot}04868} = 136{\cdot}6 \text{ atmospheres.}$$

[1] Substance of a paper read before the Royal Society of Edinburgh, June 21, by J. Y. Buchanan.

[1] *Proc.* Royal Society of London, 1876. p. 162.